Research Report

# Construction and Validation of the 4-Item Dynamic Gait Index

**Background and Purpose.** People with balance disorders often have difficulty walking. The purpose of this study was to develop and test the psychometric properties of a short form of the Dynamic Gait Index (DGI) for the clinical measurement of walking function in people with balance and vestibular disorders. **Subjects.** A total of 123 subjects with such disorders (test subjects) and 103 control subjects were included in this study. **Methods.** Rasch and factor analyses were used to create a short form of the DGI. Internal consistency and discriminative validity for test subjects versus control subjects and for falling versus nonfalling test subjects were evaluated. **Results.** Four items were selected for the shorter version of the test: gait on level surfaces, changes in gait speed, and horizontal and vertical head turns. **Discussion and Conclusion.** The clinical psychometric properties of the 4-item DGI were equivalent or superior to those of the 8-item test. The 4-item DGI can be used by clinicians to measure gait in people with balance and vestibular disorders without compromising important clinical measurement characteristics. [Marchetti GF, Whitney SL. Construction and validation of the 4-item Dynamic Gait Index. *Phys Ther.* 2006;86:1651–1660.]

**Key Words:** *Gait, Measurement, Validity, Vestibular system.*

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The purpose of this study was to examine the item fit, redundancy, and unidimensionality of the 8-item Dynamic Gait Index (DGI),[1] which quantifies gait characteristics in people with diagnosed balance and vestibular disorders. Tools to assess balance and gait assist health care professionals in making decisions about intervention and management. It is imperative that these tools be reliable, valid, and as concise as possible to optimize time management. Redundant items are less time efficient, without yielding additional data for clinical management. A shorter tool would be more clinically feasible and might make clinicians more likely to use the instrument. The DGI often has been used as a rehabilitation outcome measure, yet if it were easier to administer and shorter, it theoretically could be used as a screening tool.

The DGI was developed for use in community-living older people and also has been used for people with balance and vestibular disorders.[2–14] The DGI is an 8-item tool with which the examiner rates an individual's gait performance on an ordinal scale that ranges from 0 to 3.[1] Higher scores indicate better performance, with a maximal score of 24. Items on the DGI require people to modify their gait while ambulating. Interrater reliability for people with peripheral vestibular disorders has been reported to have a composite kappa of .64 and a Spearman rho of .95 for the 8-item test based on the scores of 2 raters.[12] The concurrent validity of the DGI and the Berg Balance Scale for people with central and peripheral vestibular disorders has been established,[8] and the DGI also correlates well with the Activities-specific Balance Confidence Scale,[4] which is a self-report scale of balance confidence.[15]

Scores on the DGI of less than 20 have been related to reported falls in community-living older people[16,17] and in people with central and peripheral vestibular dysfunction.[3,5,10] The DGI has been used widely as an outcome measure and has demonstrated change over the course of a vestibular rehabilitation program.[2,3,6,7,14] It takes approximately 10 minutes or less to complete and score the DGI. If the tool could provide comparable data with fewer items, a shorter version would make the examiner more efficient.

The purpose of this study was to determine whether the DGI could be shortened from its original form. We hypothesized that the use of fewer items on the DGI could provide results comparable to those of the 8-item DGI. Thus, a Rasch analysis was performed to determine whether a shorter version of the DGI could provide valid results without a loss of integrity of the tool. The items that were chosen for the shorter version of the DGI were selected on the basis of content, subject performance, clinical feasibility (time and equipment), and fit with the single construct of dynamic gait performance.

## Method

### *Subjects*

Data from a total of 226 people were used in these analyses; the mean age of the subjects was 56.7 years (SD=20.3, range=14–91), and 132 (58.4%) were women. A total of 123 subjects who had balance and vestibular disorders and who were seen in a tertiary-care clinic for balance disorders represented the test subjects; the mean age was 62.3 years (SD=16.3, range=14–91), and 75 (61%) were women. A total of 103 people without vestibular and balance dysfunction represented the control subjects; the mean age was 50.0 years (SD=22.5, range=21–84); 57 (55%) were women. All control subjects provided written informed consent. The test group was significantly older than the control group

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Both authors provided concept/idea/research design, writing, and facilities/equipment. Dr Marchetti provided data analysis. Dr Whitney provided data collection, project management, fund procurement, subjects, and institutional liaisons.

This study was approved by the institutional review board of the University of Pittsburgh.

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by a mean difference of 12 years ($P<.01$). The test subject DGI data were obtained from a previously published study (N=92)[10] in which DGI data were recorded retrospectively as part of an initial physical therapy examination with institutional review board approval. Data also were retrieved from a recently completed study in which DGI data were recorded prospectively (N=31). All test subjects had been referred to physical therapy for a balance or vestibular disorder that was diagnosed by a neurologist or a neurotologist.

### *Procedure*

The scoring of each item of the DGI ranges from 0 to 3, with 0 indicating that the individual is unable to perform the walking skill and 3 indicating that the individual can perform the skill normally. Each of the 8 DGI walking skills has written descriptors to assist physical therapists in scoring. All testers had to be within 1 DGI point of the second author with 5 consecutive test subjects to collect DGI data in the clinical setting.

Intertester agreement had been previously established for experienced physical therapists with the 8-item DGI for subjects (test and control) in a tertiary-care clinical setting over 2 separate testing sessions. Agreement between raters was shown to be good to excellent across all items.[18] Mean kappa statistics for 6 paired clinician ratings across the 8 items for 39 subjects ranged from .54 (walking with pivot turn) to .80 (level gait).

All of the data from people without balance and vestibular dysfunction were collected prospectively by the second author (a physical therapist) for several ongoing and previously completed studies. All control subjects had a normal neurologic examination by a board-certified neurologist, normal age-adjusted hearing, normal vestibular test results (rotational chair, caloric, positional, and oculomotor), normal corrected vision, and intact distal sensation (monofilament testing). All control subjects were recruited through advertisements and were screened by telephone for significant medical comorbidities. The score on each of the 8 DGI items was recorded, as was the DGI total score. Reports of falls in the previous 6 months were recorded for the test subjects, but those data were not collected for the control subjects. All test subjects were asked in a systematic way during the initial examination about their falls, and the information was recorded in the chart.

### *Data Analysis*

The selection of items to be retained for the shorter version of the DGI was performed with Rasch analysis for determination of the difficulty of items from the original 8-item DGI and interitem scaling for 123 people with vestibular disease.[19–23] Rasch analysis is a statistical technique that develops a continuous interval measurement scale from an ordinal outcome score by use of a logistic regression model.[19] A measurement scale was constructed from the DGI on the basis of the assumption that an individual's performance on each DGI item is a function of that individual's ability and of item difficulty. The mean total score for each subject as well as for each item on the DGI was determined from the interval scale.

Conversion to an interval scale allowed evaluation of the spread and for detection of any redundancy among the 8 items of the original DGI tool. Items that appeared to have similar difficulty and items that demonstrated a poor fit with an individual's performance on the other items were identified and eliminated. The reduced-item DGI scale then was reanalyzed to determine the difficulty of the items, the inter-item spread on the newly proposed scale, and the distribution of subject performance on the new scale. The objective of the Rasch analysis was to retain the smallest number of items that still adequately reflected an individual's ability to perform dynamic gait activities.[19] Subjects' clinical performance ratings that were unusual on the basis of the model predictions (outfit statistic) or item ratings that were unexpected on the basis of subject ability (infit statistic) were used to remove items and improve the psychometric properties of the new scale.[19,21–23]

Principal components factor analysis was used to describe the degree to which the original 8 DGI items represented the underlying construct of dynamic gait and the amount of variance in subject (test, control, and combined) performance that was explained by a single construct.[19] A subsequent factor analysis was performed after removal of the items identified previously by Rasch analysis. The factor structure and amount of variance in subject performance explained by the items in the reduced scale were estimated.

The frequencies of categorical performance ratings on the items retained for the revised DGI were described with frequency counts and percentages for each item. The internal consistency, or the relationship between individual test items, was determined for the 8-item DGI and the reduced-item DGI with both test and control subjects. The alpha coefficient, the correlation between item and total scores, and the average inter-item correlation were described and compared between the 8-item and reduced-item versions of the DGI.[19]

It is important to demonstrate that scores on the reduced-item DGI reflect performance changes attributable to the presence of vestibular or balance dysfunction. The total scores for the subjects with documented vestibular or balance dysfunction on the reduced-item test were compared with those for the control subjects. Statistical comparison between the 2 groups was made by use of the nonparametric Mann-Whitney *U* test with a type I error rate of less than .05. Because of the significant age difference between the test and control subject groups, this analysis also was performed with subjects stratified by age at younger than 65 years and 65 years and older.

The discriminative abilities of the gait measures, recorded with the reduced-item DGI, to detect performance changes attributable to vestibular or balance dysfunction were compared with those of the 8-item DGI by use of receiver operating characteristic curve (ROC) analysis.[24] For both the 8-item test and the reduced-item test total scores, the sensitivity and specificity for identifying test and control subjects were determined for each possible total score. The area under the curve (AUC) that was generated by plotting sensitivity against the rate of false-positive results (1 − sensitivity) for detecting test and control subjects was tested against a null-hypothesis AUC of .50, indicating no discriminative value.

Curves for both the 8-item test and the reduced-item test total scores were analyzed by use of a type I error rate of less than .05. The total scores on both the 8-item DGI and the reduced-item DGI that maximized the sensitivity and specificity for discriminating test subjects from control subjects were identified. Because of the significant mean age difference between the test and control subjects, with test subjects generally being older, the ROC curve analysis was performed for subjects stratified by age at younger than 65 years and 65 years and older.

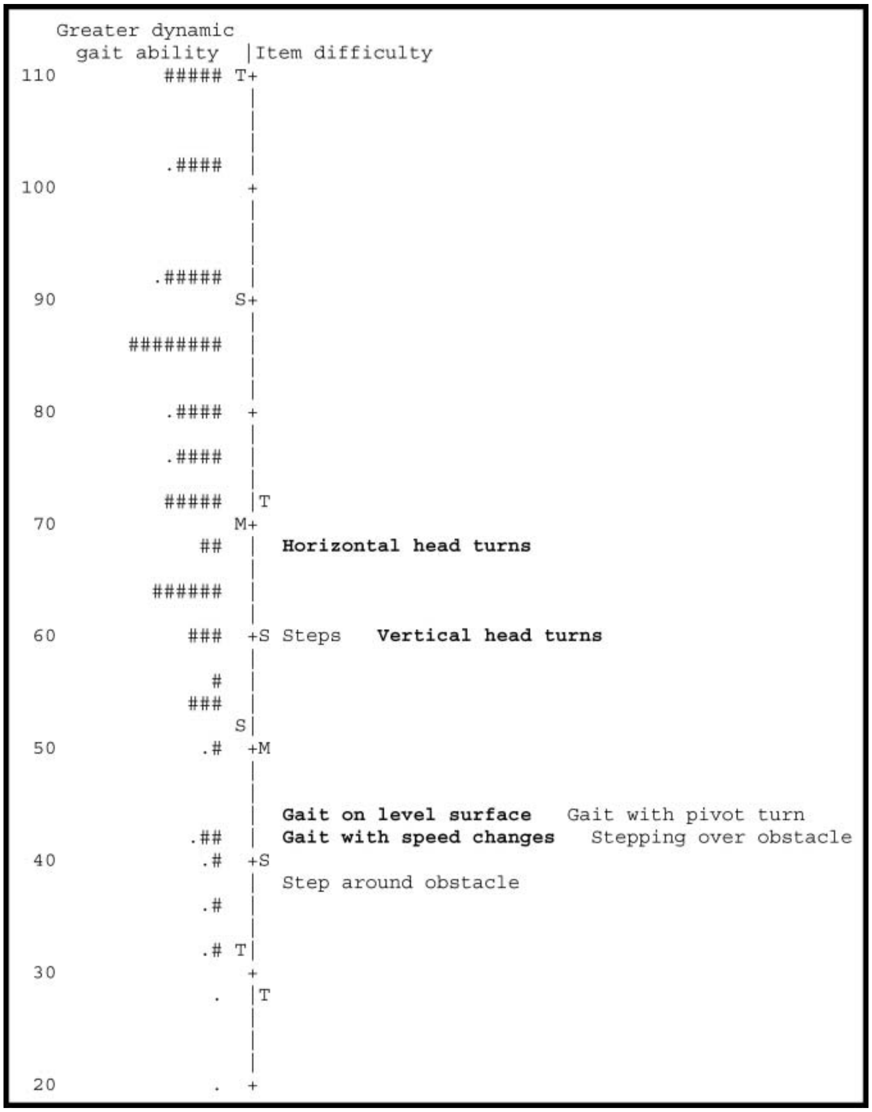


**Figure 1.**
Subject-item map for the 8-Item Dynamic Gait Index (DGI). The DGI items are aligned on the right from bottom to top in order of increasing difficulty. Subjects with vestibular and balance dysfunction (n=123) are represented on the left (dot=1 subject, number sign=2 subjects) in order of increasing difficulty in the performance of the DGI items from bottom to top. Items that were retained for the reduced-item DGI are depicted in bold type. Labels M, S, and T indicate the mean (M), 1 standard deviation (S), and 2 standard deviations (T) for the item or subject studied. The scale on the left is the transformed interval scale with an item mean of 50.

It is important that scores on the reduced-item DGI reflect performance variations attributable to vestibular or balance disease severity. Total scores on the reduced-item test were compared between 34 test subjects who reported at least 1 fall in the 6 months prior to examination and 89 test subjects who had no self-reported falls. Statistical comparison between the 2 groups was made by use of the nonparametric Mann-Whitney *U* test with a type I error rate of less than .05.

The discriminative abilities of the reduced-item DGI to detect performance changes attributable to disease severity as reflected by a history of falling were compared with those of the 8-item DGI by use of ROC analysis.[24] For both the 8-item test and the reduced-item test total scores, the sensitivity and specificity for discriminating test subjects who reported falling from those not reporting falling were determined for each possible total score. The AUC that was generated by plotting the sensitivity against the rate of false-positive results (1 − sensitivity) for discriminating subjects who reported falling from

**Table 1.**
Rasch Analysis Results for 8-Item Dynamic Gait Index (DGI) for 157 Test and Control Subjects[a]

| Item | Item Measure[b] | SE | Infit ZSTD | Outfit ZSTD | PTBis |
|---|---|---|---|---|---|
| Horizontal head turns | 68.8 | 1.4 | 0.7 | 0.5 | .86 |
| Steps | 63.7 | 1.5 | 1.6 | 2.9 | .78 |
| Vertical head turns | 59.4 | 1.5 | −0.3 | −0.8 | .84 |
| Stepping over obstacle | 44.1 | 1.8 | 0.9 | 1.6 | .72 |
| Gait on level surface | 43.5 | 1.8 | −3.9 | −3.0 | .82 |
| Gait with pivot and stop | 43.5 | 1.8 | 3.7 | 0.8 | .69 |
| Gait with speed changes | 40.9 | 1.8 | −3.1 | −3.1 | .79 |
| Stepping around obstacle | 35.9 | 2.0 | 0.6 | −1.3 | .70 |

[a] Test subjects had vestibular and balance dysfunction. Data include item and total mean transformed measure scores, standard errors (SE), infit and outfit standardized scores (ZSTD), and point biserial correlation coefficients (PTBis). The DGI items are listed in order of decreasing difficulty.
[b] Data for 13 test subjects and 59 control subjects were omitted because of maximum scores. Transformed scale: $\overline{X}$=50, SD=11.4, range for subjects=18.5–102.7.

**Table 2.**
Rasch Analysis Results for 4-Item Dynamic Gait Index (DGI) for 131 Test and Control Subjects[a]

| Item | Item Measure[b] | SE | Infit ZSTD | Outfit ZSTD | PTBis |
|---|---|---|---|---|---|
| Horizontal head turns | 73.9 | 1.8 | 1.6 | 1.4 | .90 |
| Vertical head turns | 59.2 | 1.8 | 0.9 | 0.9 | .89 |
| Gait on level surface | 35.4 | 2.2 | −1.7 | −0.2 | .87 |
| Gait with speed changes | 31.5 | 2.3 | −1.6 | −1.7 | .85 |

[a] Test subjects had vestibular and balance dysfunction. Data include item and total mean transformed measure scores, standard errors (SE), infit and outfit standardized scores (ZSTD), and point biserial correlation coefficients (PTBis). The DGI items are listed in order of decreasing difficulty.
[b] Data for 20 test subjects and 75 control subjects were omitted because of maximum scores. Transformed scale: $\overline{X}$=50, SD=17.43, range for subjects=4.2–128.4.

those not reporting falling was tested against a null-hypothesis AUC of .50, indicating no discriminative value. The curves for both the 8-item test and the reduced-item test total scores were analyzed by use of a type I error rate of less than .05. The total scores on both the 8-item DGI and the reduced-item DGI that maximized the sensitivity and specificity for discriminating test subjects who reported falling from test subjects who had no self-reported falls in the previous 6 months were identified.

The WINSTEPS Rasch Measurement Software, version 3.57,* was used for Rasch and principal components analyses. The Statistical Package for Social Sciences, version 13.0,† was used to determine the internal consistency and abilities to discriminate between test and control subjects and between test subjects who reported having fallen and those who had no reports of recent falls (in the previous 6 months).

## Results

Figure 1 provides an illustration of the item and subject scoring for the 8-item DGI for 123 test subjects on the basis of Rasch analysis. The DGI items at the same vertical positioning on the map represent items at the same level of difficulty.[22] On the basis of item difficulty and inter-item scaling, 4 items were selected for the reduced-item DGI: horizontal head turns, vertical head turns, gait on level surfaces, and changes in gait speed.

**Table 3.**
Single-Construct Factor Loading Values for the 8-Item Dynamic Gait Index for the Total Sample (N=226) and for the Subsample of Test Subjects (n=123)[a]

| Item | All Subjects | Test Subjects |
|---|---|---|
| Gait on level surface | .90 | .81 |
| Gait with speed changes | .94 | .89 |
| Horizontal head turns | .82 | .77 |
| Vertical head turns | .84 | .79 |
| Gait with pivot turn | .73 | .66 |
| Stepping over obstacle | .79 | .78 |
| Stepping around obstacle | .81 | .80 |
| Steps | .67 | .54 |

[a] Test subjects had vestibular and balance dysfunction.

Tables 1 and 2 show the results of the Rasch analysis for the 8-item DGI and the 4-item DGI, respectively. The ordinal 4-item scale of 0 to 12 was logarithmically transformed into a continuous interval scale. The performance of subjects who demonstrated a "misfitting" response pattern was eliminated from the Rasch analysis.[21] The modeled probability based on the 4-item difficulty and the test subject ability was based on 131 subjects, with 20 test subjects and 75 control subjects being eliminated on the basis of their poorly fitting gait data. The 94 subjects who were eliminated demonstrated no deficits in dynamic gait and achieved the maximum score (12 of 12) on the 4-item DGI. An estimation of

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† SPSS Inc, 233 S Wacker Dr, Chicago, IL 60606.

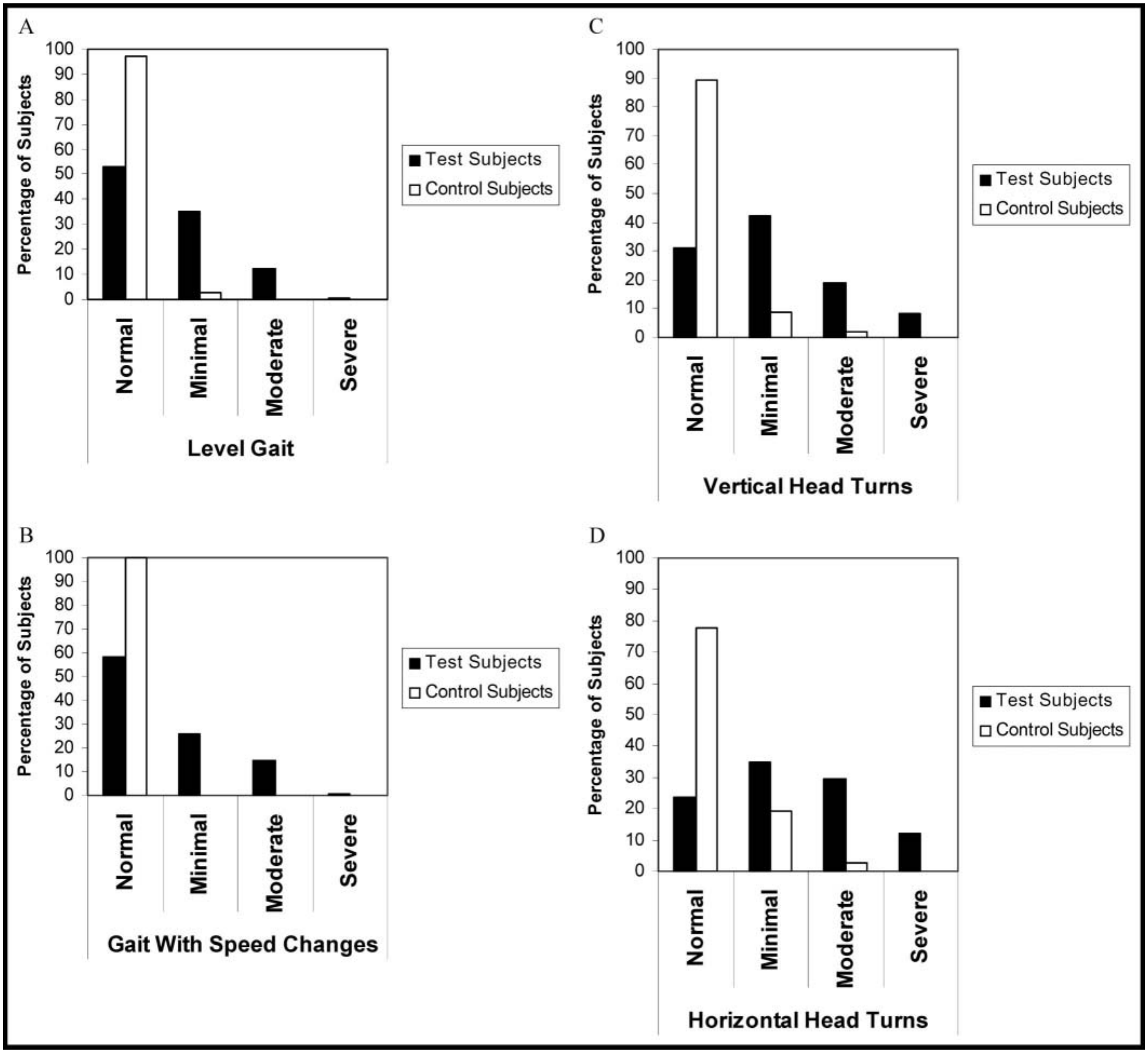


**Figure 2.**
Percentage distributions of categorical performance ratings for subjects with vestibular and balance dysfunction (test subjects) (n=123) and control subjects (n=103) on the following Dynamic Gait Index items: (A) gait on level surface (level gait), (B) gait with speed changes, (C) vertical head turns, and (D) horizontal head turns.

model fit on the basis of test subject ability could not be made from the maximum score.

From Tables 1 and 2 it can be observed that the most difficult dynamic gait item, with an item score of 73.9, was walking with horizontal head turns. The closer the number is to 100, the more difficult it is for an individual to perform. The least difficult item was walking with speed changes (31.5). The relatively consistent error for each item indicated that the precision of the difficulty estimate was consistent across the 4 items.

The Rasch model fit statistics (infit and outfit) are presented as standardized scores (ZSTD). Infit ZSTD describes the difference in the overall data between the model prediction and the observed subject performance on the item.[19] Outfit ZSTD describes the average divergence of the item difficulty and the subject performance from what would be predicted by the Rasch model for each item.[19] Infit ZSTD and outfit ZSTD have expected values of 0. The signs of ZSTD indicate whether more (positive) or less (negative) variation than expected from the model is demonstrated by the response data.

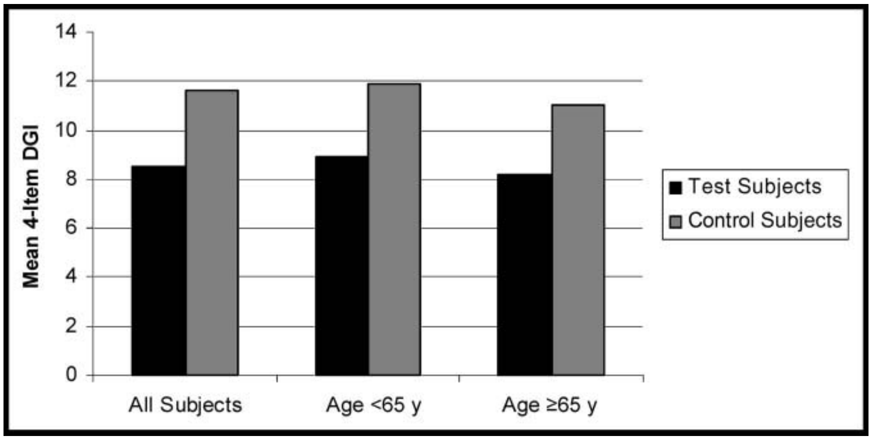


**Figure 3.**
Mean 4-Item Dynamic Gait Index (DGI) raw total scores for subjects with vestibular and balance dysfunction (test subjects) and control subjects. Subjects were stratified by age at younger than 65 years and 65 years and older.

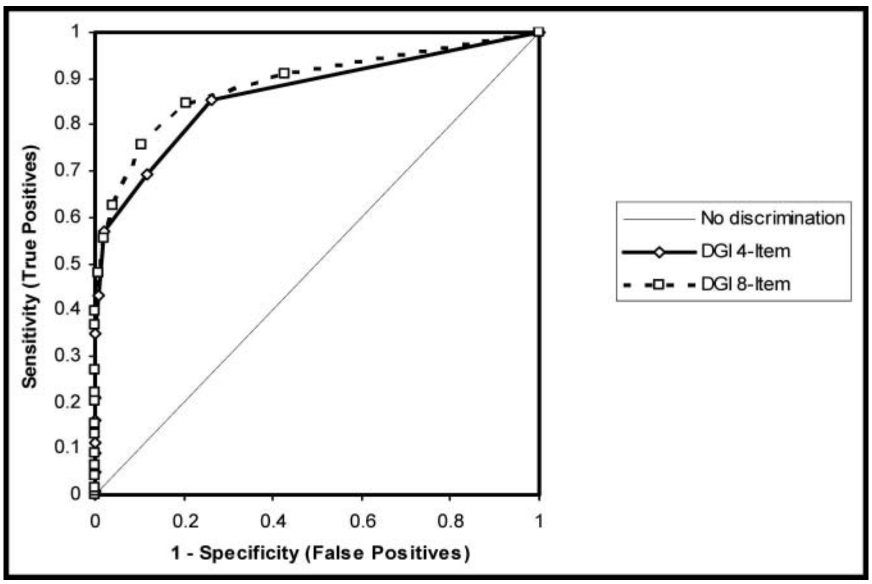


**Figure 4.**
Receiver operating characteristic curves for discrimination between 123 subjects with vestibular and balance dysfunction (test subjects) and 103 control subjects for the 8-item and 4-item Dynamic Gait Index (DGI) raw total scores.

Infit and outfit ZSTD scores of greater than +2 or less than −2 are interpreted as having less compatibility with the model than expected ($P$<.05).[19] The 4 retained items demonstrated satisfactory fit with test subject performance ratings. The point biserial correlation coefficients shown in Tables 1 and 2 indicate the correlations (−1 to +1) between each item score and the cumulative score obtained from the remaining items across the test subject sample. The point biserial correlation coefficients indicate a satisfactory fit within the domain of dynamic gait performance.[19] The overall model fit statistics show a mean infit ZSTD of −0.1 and a mean outfit ZSTD of −0.2 across the 4 DGI items, indicating a highly satisfactory fit with the construct of dynamic gait. The subject separation reliability for the 4-item DGI was shown to be high (.79). The item difficulty separation reliability was shown to be excellent (.99).

Principal components factor analysis of the 8-item DGI demonstrated that 65.5% of the total variance for the combined sample of test and control subjects was explained by a single construct. For the subsample of 123 test subjects, 59.4% of the variance in the 8-item DGI was explained by a single construct. Table 3 shows the proportional factor loading for each item on the single construct.

A single underlying construct explained a greater proportion of the variance with the 4-item DGI than with the 8-item DGI. Factor analysis of the 4-item DGI showed that, for all subjects, a single construct explained 78.7% of the variance in performance; the factor loadings for the 4 items ranged from .85 to .91. For the subsample of test subjects, a single construct explained 74.8% of the variance in the performance ratings on the 4 items; the factor loadings for the 4 items ranged from .82 to .90.

Figure 2 shows the percentages of scores across the grading criteria (0–3) on the 4-item DGI for the test and control subjects. Horizontal and vertical head turns were difficult for both test and control subjects. Control subjects demonstrated minimal impairment in level gait and no impairment in gait with speed changes.

The internal consistency of the 4-item DGI compared favorably with that of the 8-item DGI. The 4-item DGI demonstrated excellent internal consistency. For all subjects (test and control), the Cronbach alpha was .89. Correlations between item and total scores ranged from .75 (horizontal head turns) to .82 (level gait). For the subsample of test subjects, the Cronbach alpha was .88. Correlations between item and total scores ranged from .69 (horizontal head turns) to .80 (level gait). The Cronbach alpha values for the 8-item test were .92 for all subjects and .88 for the subsample of test subjects.

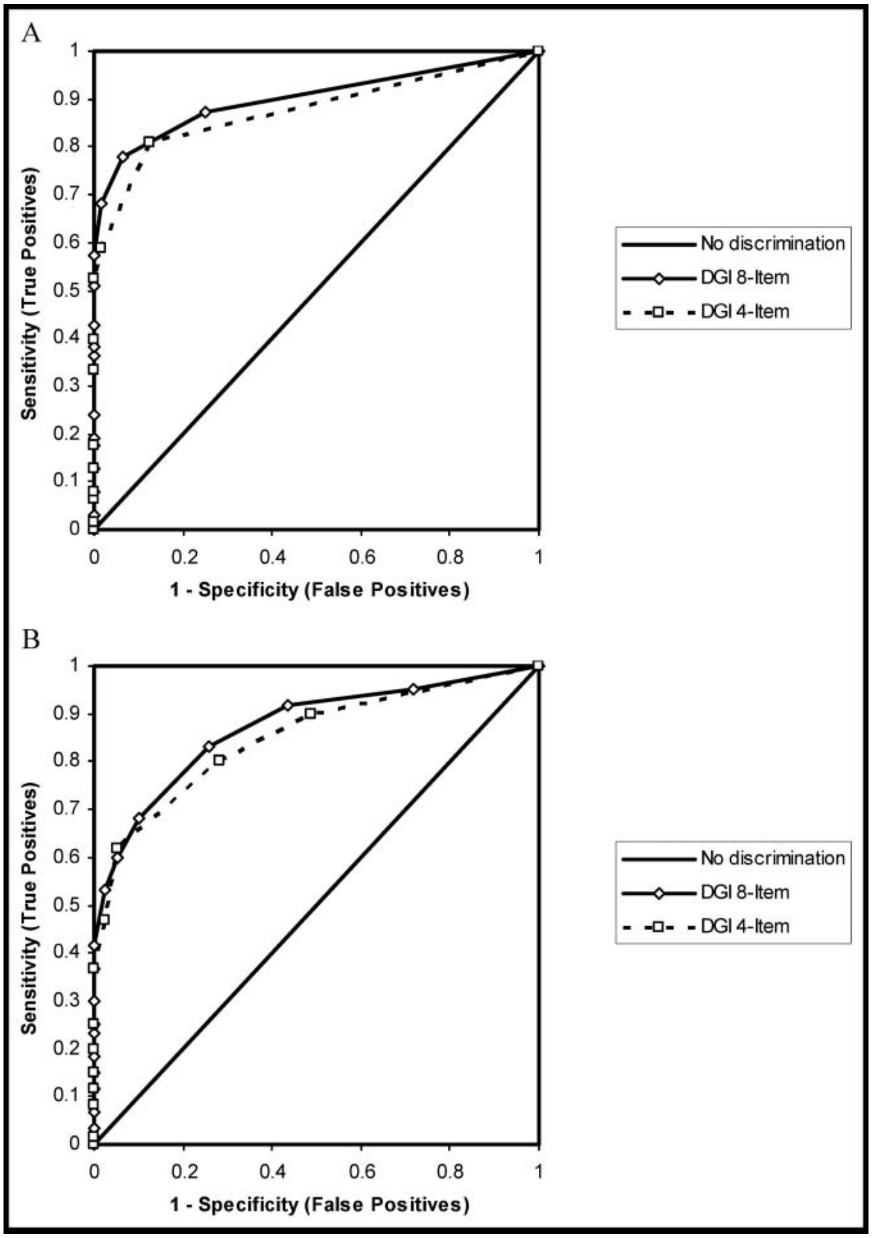


**Figure 5.**
Receiver operating characteristic curves for discrimination between subjects with vestibular and balance dysfunction (test subjects) and control subjects for the 8-item and 4-item Dynamic Gait Index (DGI) raw total scores stratified by age at (A) younger than 65 years and (B) 65 years and older.

The mean 4-item DGI total scores for test and control subjects in the entire subject sample and for subjects stratified by age at younger than and older than 65 years are shown in Figure 3. Control subjects demonstrated significantly higher 4-item DGI total scores than test subjects in all groups (Mann-Whitney *U* test, $P<.01$).

The ROC curves that describe the abilities of the 8-item and 4-item DGI total scores to identify test and control subjects are shown in Figure 4. The AUCs for both the 4-item DGI and the 8-item DGI were significant compared with the null AUC of .50 ($P<.01$). The 4-item DGI appeared to provide identification of test and control subjects similar to that of the 8-item DGI. The AUC for the 8-item DGI total score was .89. The AUC for the 4-item DGI total score was .87. With a cutoff score of less than 12 of 12, the 4-item DGI total score was 85% sensitive and 74% specific for identifying test subjects in the sample of 226 subjects.

Because of the difference in ages between the control and test groups, an ROC curve for subjects stratified by age at younger than 65 years and 65 years and older was calculated and is shown in Figure 5. The AUCs for both the 8-item DGI and the 4-item DGI were significantly different from the null AUC of .50 ($P<.01$). For both age strata, the AUC of the 4-item test was similar to that of the 8-item test in identifying test subjects.

Test subjects who did not report a fall had significantly higher (better) 4-item DGI total scores than test subjects who reported having fallen in the previous 6 months. The mean 4-item DGI total scores were 7.1 for test subjects with a history of falls in the 6 months prior to examination and 9.0 for test subjects without a history of falls (Mann-Whitney *U* test, $P<.01$).

Figure 6 displays the ROC curves that describe the abilities of the 8-item DGI and 4-item DGI total scores to identify test subjects with a history of falls and test subjects who had not fallen in the 6 months prior to examination. The AUCs for both tests were significantly different from the null AUC of .50 ($P<.01$). The 4-item test appeared to provide identification of test subjects with a history of falls similar to that of the 8-item test. The AUC for both the 8-item DGI total score and the 4-item DGI total score was .67.

The optimal identification of test subjects who had reported a fall occurred with a cutoff of 19 of 24 or less for the 8-item test total score (68% sensitivity and 60% specificity). The optimal identification of test subjects who had reported a fall occurred with a cutoff of 9 of 12 or less for the 4-item test total score (56% sensitivity and 62% specificity). The 4-item test total score appeared to be slightly

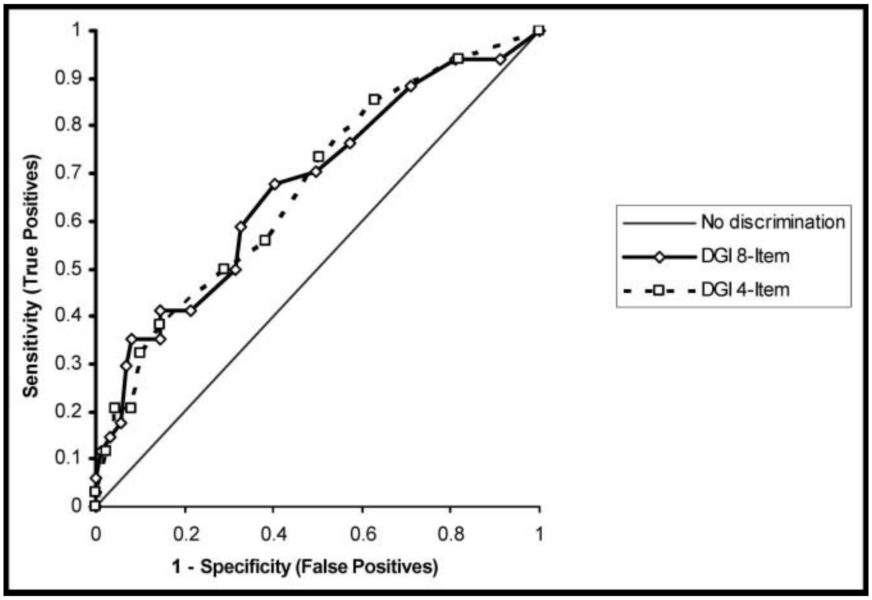


**Figure 6.**
Receiver operating characteristic curves for discrimination between subjects who had reported a fall (n=34) and subjects who had no reported falls in the previous 6 months (n=89) for the 8-item and 4-item Dynamic Gait Index (DGI) total scores.

less sensitive but similarly specific for identifying test subjects who had reported a fall in the previous 6 months.

## Discussion

The 4-item DGI provides information similar to that provided by the 8-item DGI, yet it is faster to perform and requires no equipment. The psychometric properties of the 4-item DGI were comparable or superior to those of the original 8-item DGI. The 4-item DGI better represented a single construct of dynamic gait than the 8-item DGI. Several of the 4-item DGI tasks were chosen because they required no equipment. Climbing steps and vertical head turns had similar levels of difficulty on the transformed Rasch scale. On factor analysis, stair climbing was shown to be related to a different construct and to contribute less to internal consistency than vertical head movements during gait. Vertical head turns were included in the 4-item DGI because not all places where people are tested have stairs. Because a change in gait speed, stepping over an obstacle, and stepping around an obstacle were considered to have similar levels of difficulty, a change in gait speed was chosen to represent that level of difficulty. Therefore, no equipment is required for the 4-item DGI. The 8-item DGI requires people to walk around cones, walk over an object, and climb up and down stairs.

Head turns in the horizontal plane were more difficult than head movements in the vertical plane during gait for people with balance and vestibular disorders in the present study and in another reported study.[10] It was unexpected that walking straight would be slightly more difficult than walking with a change in speed, although the items had similar levels of difficulty (35.4 versus 31.5; Tab. 2). Less than optimal performance while walking on level surfaces and walking at different speeds appeared to best identify people with the greatest impairments. Therefore, both items were retained because it was believed that including both items (walking on level surfaces and walking with changes in speed) would improve the precision of measurement at this level of function (Fig. 2).

Mild instability of gait while moving the head (up or down and right or left) is a relatively common condition in control subjects, although greater difficulty with walking with head movements was seen in older people. Eleven percent of the younger control subjects and 41% of the control subjects 65 years and older scored 2 (mild impairment) or less on horizontal head turns. Similarly, 3% of younger control subjects and 23% of control subjects 65 years and older scored 2 (mild impairment) or less on vertical head movements during walking.

The discriminative validity of inferences from the 4-item DGI is equivalent to that of the 8-item DGI. The 4-item tool can allow differentiation between control subjects and subjects with balance and vestibular disease. In addition, the 4-item DGI allows differentiation of subjects with a self-reported history of falling from those without a self-reported history of falling. The 8-item DGI total score is more sensitive at its optimal cutoff value for identifying people who have reported a fall, yet the 4-item DGI total score is more specific at its optimal cutoff value. Without prospective data, it is impossible to accurately determine the predictive validity of the 4-item DGI or the 8-item DGI for a future fall event. With regard to the use of the 4-item DGI as a screening tool for falls, the higher specificity of the 4-item DGI suggests that a closer evaluation of fall risk factors is indicated if an individual has a score of less than 10 of 12.

Future plans for the 4-item DGI include comparing the 4-item DGI score to quantitative gait analysis as a means to validate the ordinal scoring of the DGI. In addition, the responsiveness of the 4-item DGI to changes in subject status over the course of vestibular rehabilitation will be investigated. In order to demonstrate the stability of this model across groups of subjects, a follow-up study that tests the model with an independent group of subjects is necessary to validate the findings.

## Conclusion

The 4-item DGI appears to be sufficient to identify gait responses to changing task demands in people with balance and vestibular disorders and reduces examination time without compromising information gained about dynamic gait.

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